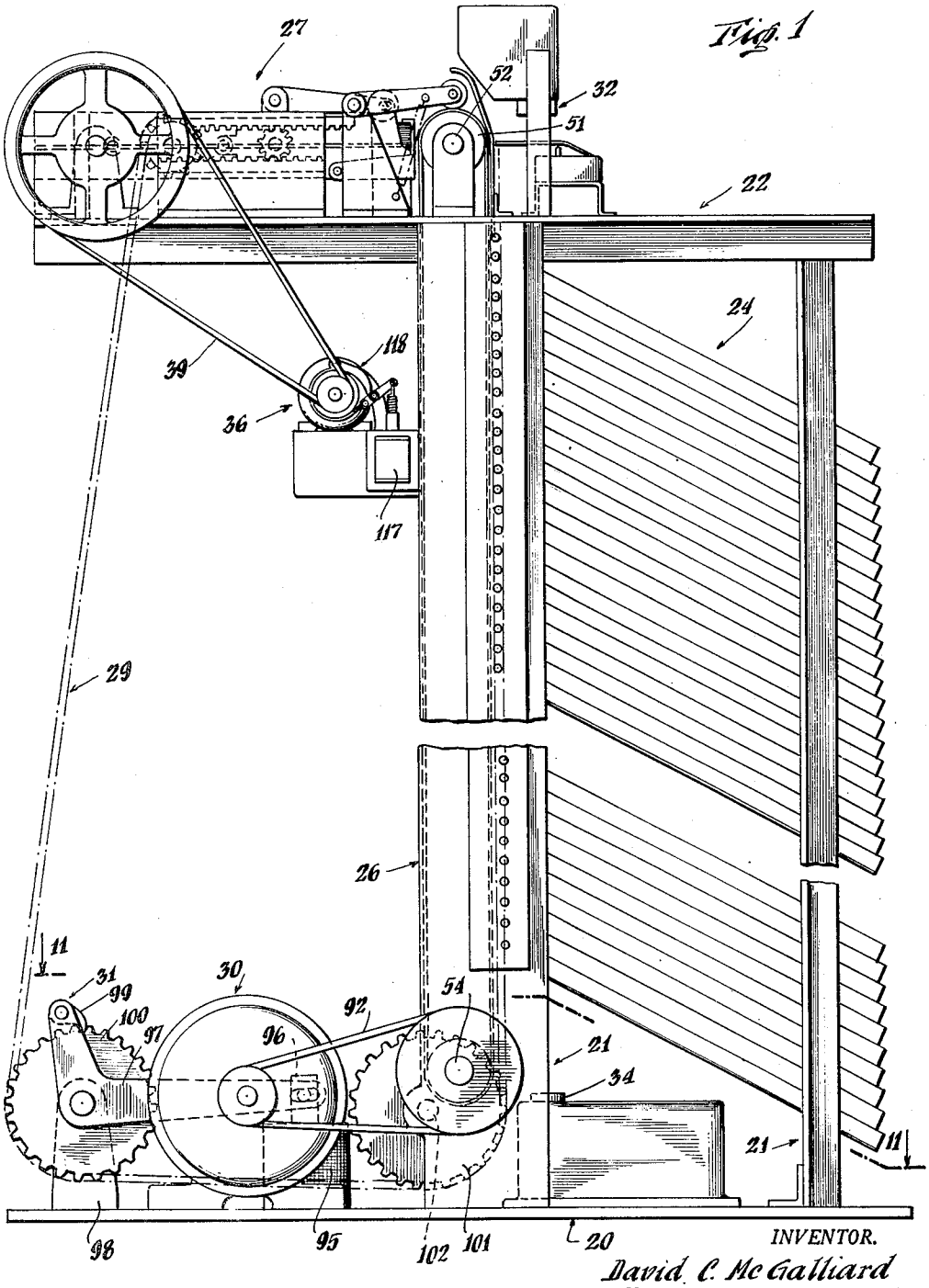
Dec. 1, 1953 D. C. McGALLIARD 2,661,209

SHEET DISTRIBUTOR

Filed June 18, 1949 6 Sheets-Sheet 1

Fig. 1



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SHEET DISTRIBUTOR

Filed June 18, 1949 6 Sheets-Sheet 2

Fig. 2

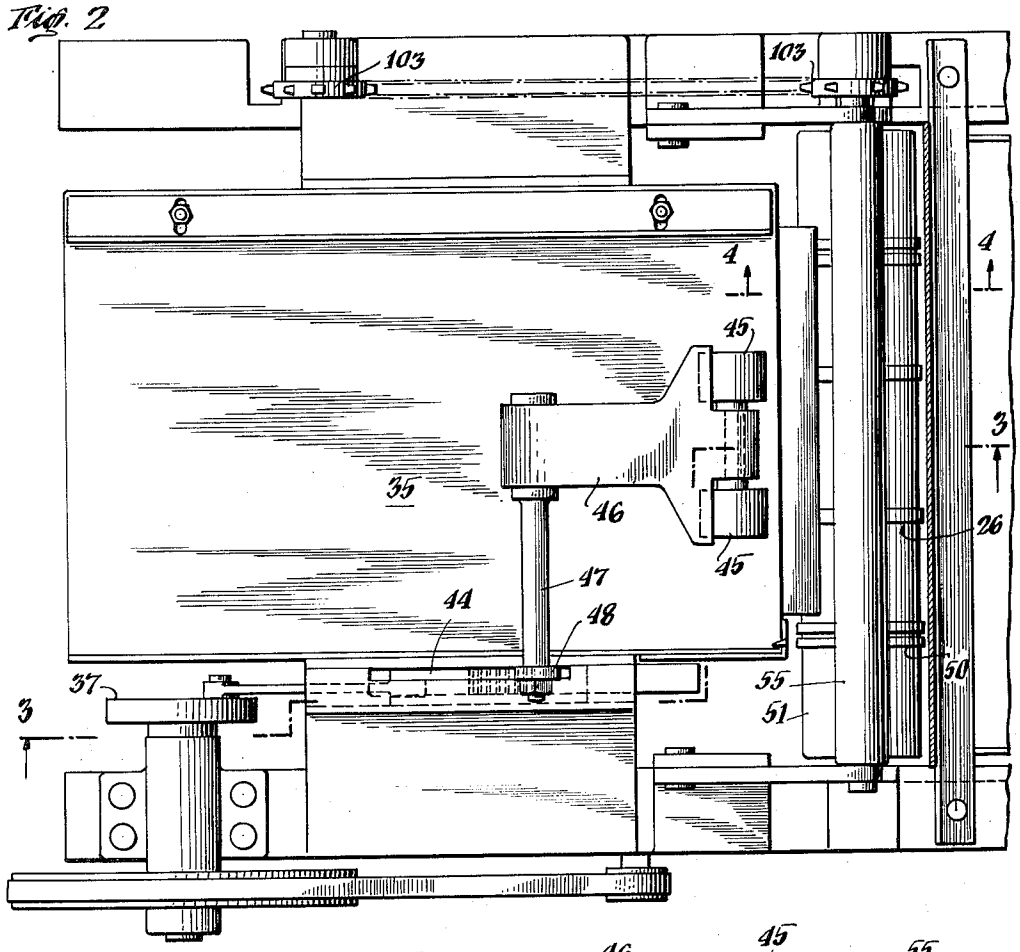
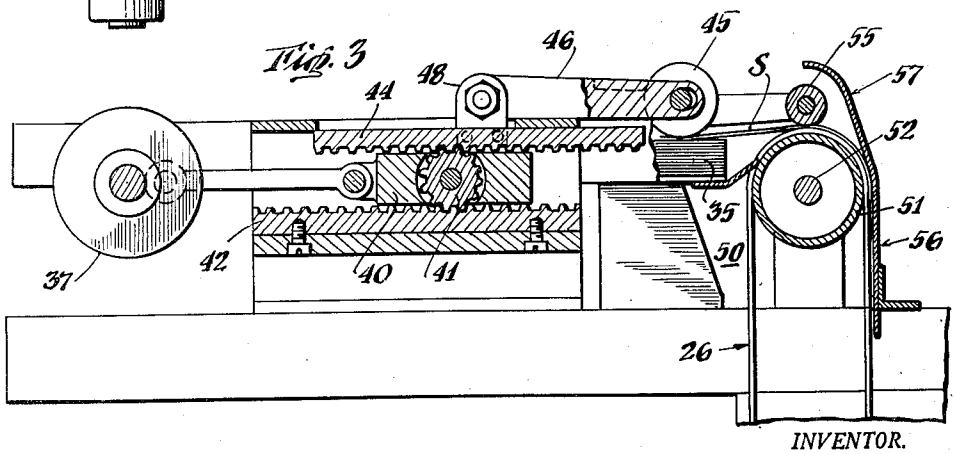


Fig. 3



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SHEET DISTRIBUTOR

Filed June 18, 1949 6 Sheets-Sheet 3

Fig. 4

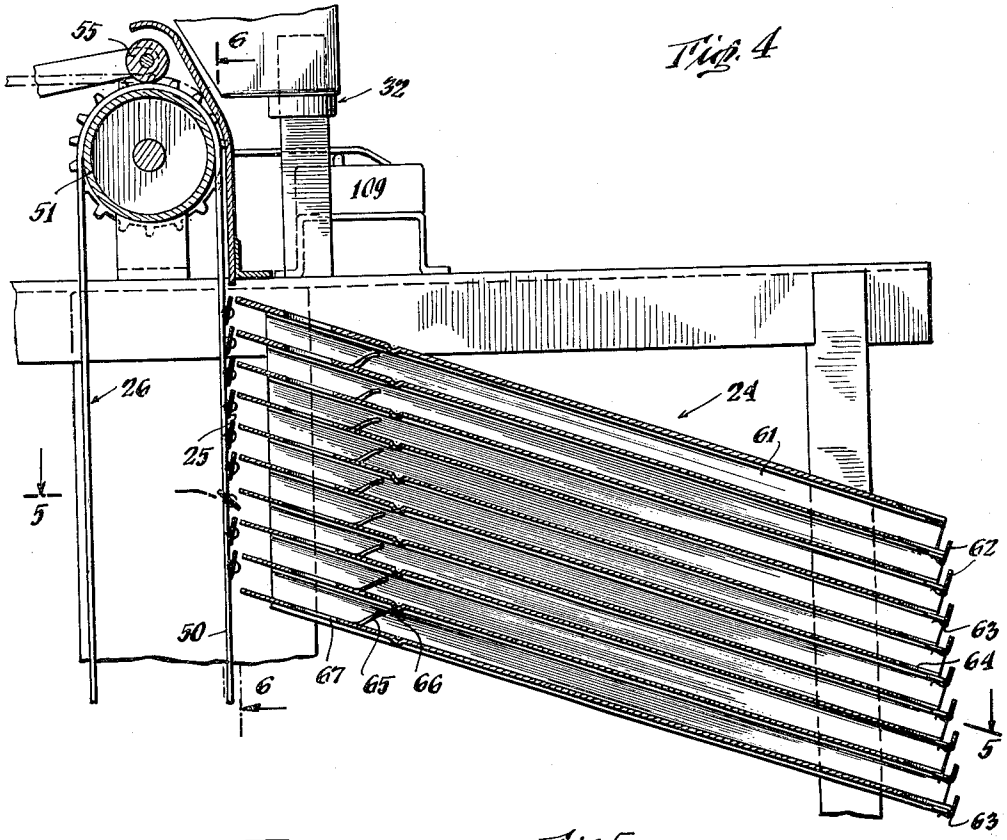
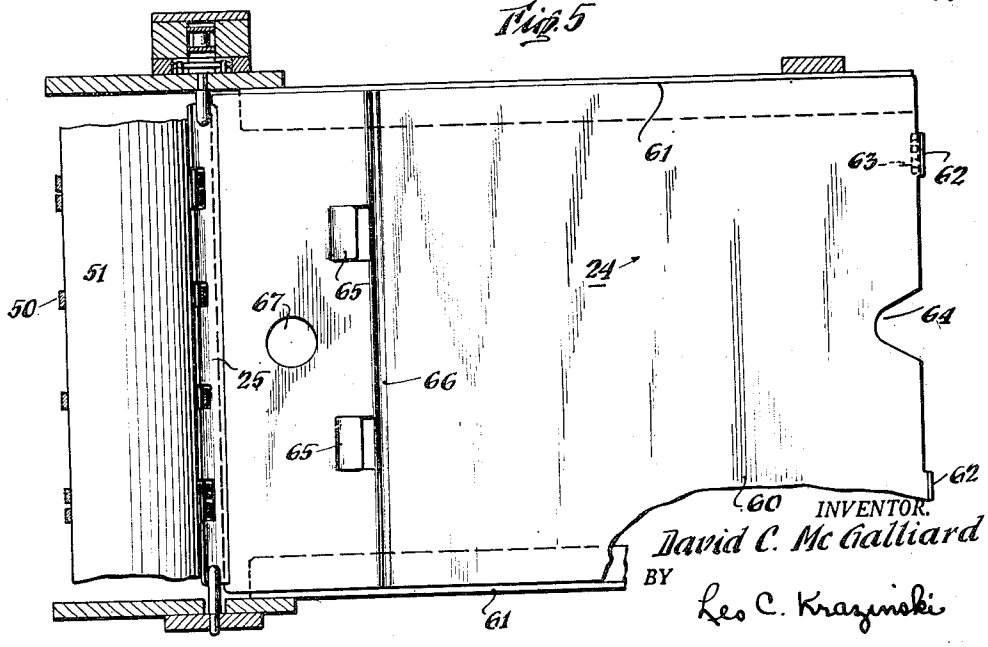


Fig. 5



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SHEET DISTRIBUTOR

Filed June 18, 1949 6 Sheets-Sheet 4

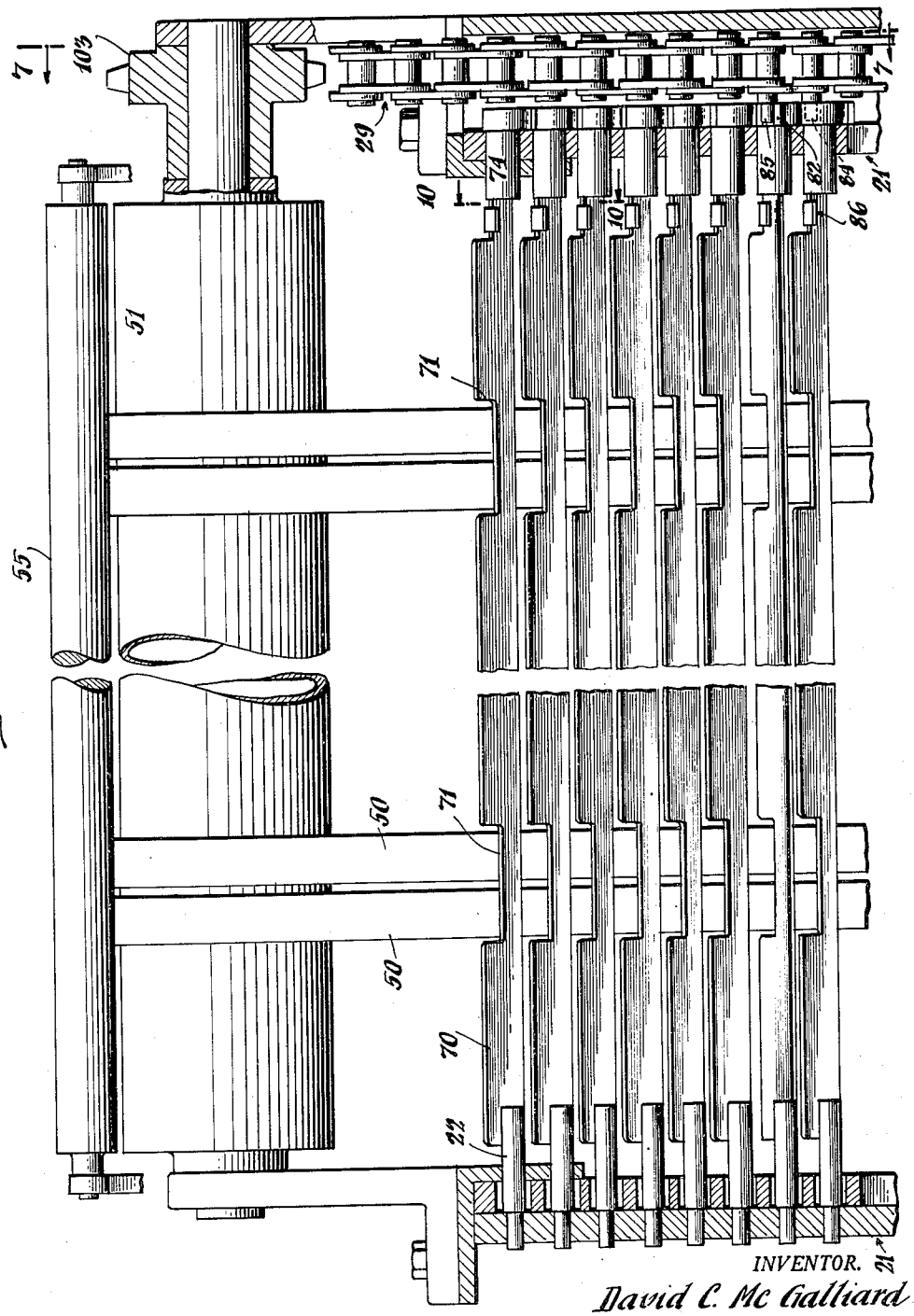


Fig. 6

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SHEET DISTRIBUTOR

Filed June 18, 1949 6 Sheets-Sheet 5

Fig. 9

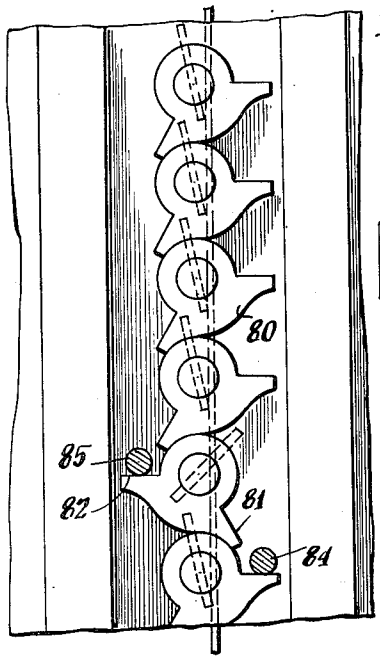


Fig. 7

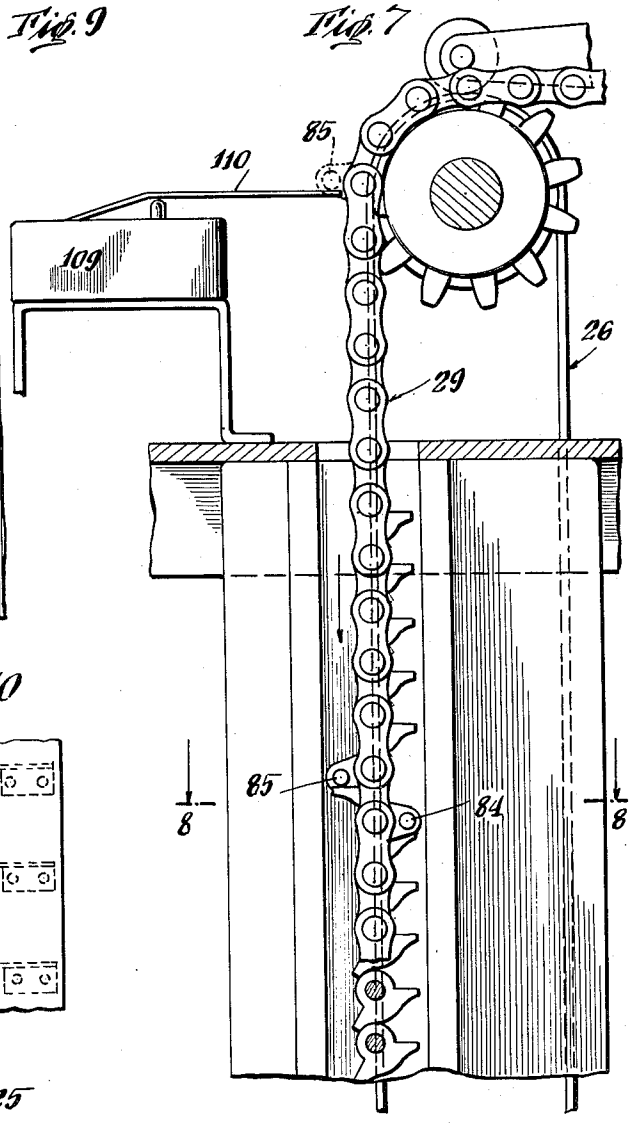


Fig. 10

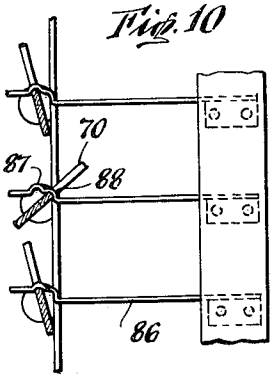
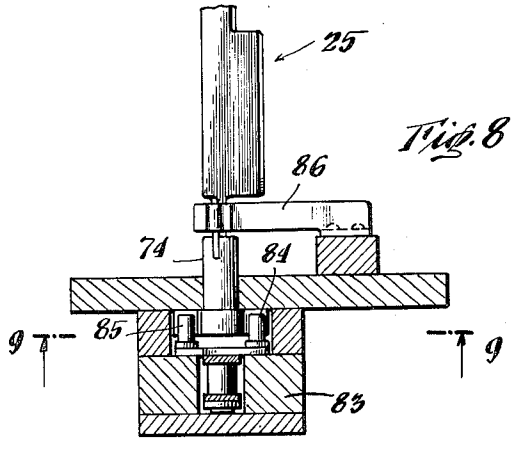


Fig. 8



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SHEET DISTRIBUTOR

Filed June 18, 1949 6 Sheets-Sheet 6

Fig. 11

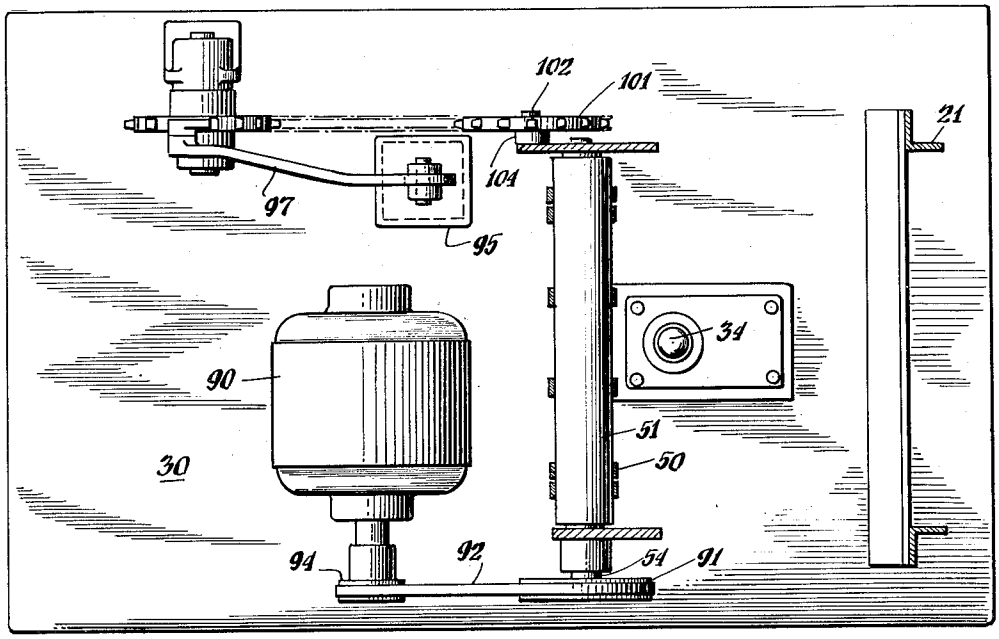
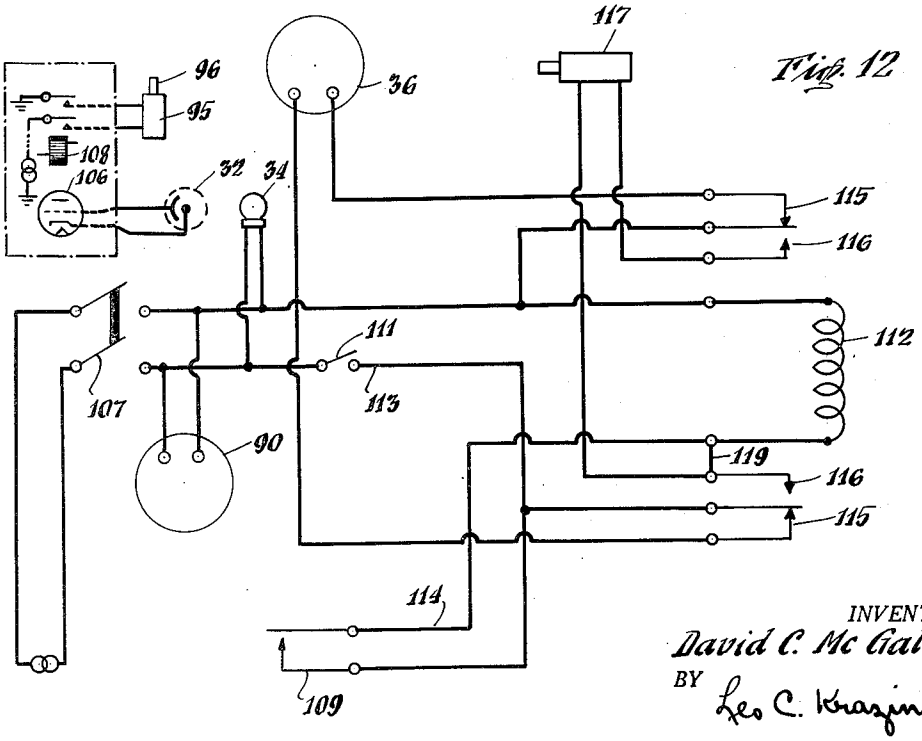


Fig. 12



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Patented Dec. 1, 1953 2,661,209

UNITED STATES PATENT OFFICE

2,661,209

SHEET DISTRIBUTOR

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Application June 18, 1949, Serial No. 100,033

11 Claims. (Cl. 271—64)

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The present invention relates to sheet material associating devices and, more particularly, to improvements in sheet distributors.

The present invention is primarily concerned with sheet distributors for arranging a plurality of sets of sheets which are thereafter fastened together to provide pamphlets, brochures, booklets, or the like.

Accordingly, an object of the present invention is to provide a sheet distributor which is adapted to arrange a large number of sets of sheets or the like, for example fifty, one hundred, or even more sets, and yet is relatively simple in construction.

Another object is to provide such a sheet distributor wherein the sheets are handled in a manner to eliminate errors in arranging the sets.

Another object is to provide a sheet distributor which is extremely rapid in operation.

Another object is to provide a sheet distributor wherein improved automatic means control the operation thereof sequentially in a step-by-step manner.

Another object is to provide a sheet distributor wherein the rebounding of sheets in the compartments and resultant interference in the control circuit is prevented while they are being arranged in sets.

Another object is to provide a sheet distributor which facilitates fastening the sheets together after being arranged in sets.

A further object is to provide a sheet distributor which facilitates removal of the sets of sheets therefrom.

Other and further objects will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the invention, the foregoing objects are accomplished by providing a sheet distributor generally comprising compartments for collecting sheets, means for delivering sheets to the compartments, gate means for each of the compartments operable to direct sheets from the delivering means into the compartments and to prevent the entry of sheets into the compartments, means responsive to the entry of sheets into the compartments, and means under the control of the last mentioned means for moving the gate means from a sheet directing position to an entry preventing position.

Preferably, the compartments are in the form

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of inclined trays positioned one above another and having aligned openings through which a beam of light is directed from a source to a photoelectric cell. Interruption of the beam by sheets being deposited in the trays deenergizes a solenoid circuit which solenoid upon being reenergized drives a chain or the like step-by-step, the chain having elements thereon for effecting positioning of the gate means. The delivering means are in the form of a belt conveyor adjacent the entrances of the trays and the gate means are constructed and arranged to positively direct sheets from the conveyor to the entrances.

Rebounding of the sheet is prevented by means which permit the sheets to be deposited in the trays but prevent movement of the sheets backwards towards the tray entrances. Fastening of the sheets together in sets is facilitated by openings in the trays permitting access to edge portions of the sheets, and removal of the sheets in sets from the trays is facilitated by hinged retaining members.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein:

Figure 1 is a side elevational view illustrating a sheet distributor in accordance with the invention;

Figure 2 is a fragmentary top view illustrating means for feeding sheets from a stack of sheets;

Figure 3 is a stepped sectional view taken substantially along the line 3—3 on Figure 2;

Figure 4 is a fragmentary sectional view of the sheet delivering means taken along the line 4—4 on Figure 2 but also illustrating the sheet collecting trays and the gates associated therewith;

Figure 5 is a sectional view taken along the line 5—5 on Figure 4;

Figure 6 is an enlarged fragmentary sectional view taken along the line 6—6 on Figure 4 illustrating the gates and their operating means;

Figure 7 is a fragmentary sectional view taken along the line 7—7 on Figure 6 illustrating details of the gate operating means;

Figure 8 is a sectional view taken along the line 8—8 on Figure 7;

Figure 9 is a sectional view taken along the line 9—9 on Figure 8 illustrating the operation of the gates;

Figure 10 is a sectional view taken along the line 10—10 on Figure 6 illustrating the gates in relation to the sheet delivering means;

Figure 11 is a top view of the chain and belt driving means, including the light source for the photoelectric cell, as seen along the line 11—11 on Figure 1;

Figure 12 is a diagrammatic view of a simplified electrical circuit for controlling the sheet distributor.

Referring to the drawings in detail and more particularly to Figure 1, there is shown a sheet distributor which generally comprises a base 20, an upright frame 21 mounted on the base, a platform 22 at the upper end of the frame for supporting a stack of sheets or the like, a plurality of sheet collecting trays 24 supported by the frame between the base and the platform, each having a gate 25 (Fig. 4) associated therewith, conveyor means 26 cooperating with the gates for delivering sheets to the trays, mechanism 27 for feeding sheets from the stack to the conveyor means, means for operating the gates including a belt or chain 29, a drive unit 30 on the base for the chain and the conveyor means, and means including a drive connection 31 under the control of a photoelectric cell 32 and light source 34 for intermittently rendering the drive unit 30 effective to operate the chain. These elements will be described in detail in the sections about to follow:

Sheet feeding mechanism

The sheet feeding mechanism, illustrated in Figures 1, 2, and 3, is constructed and arranged to push the uppermost sheets of a stack 35 of sheets into position to be carried away by the conveyor means 26. As shown, such mechanism comprises a motor 36 (Figure 1) mounted on the frame 21 adjacent the upper end thereof, an eccentric 37 (Figure 3) mounted on the platform 22 driven by the motor through a belt 39, a head 40 movably mounted on the platform and reciprocated by the eccentric, a gear 41 rotatably mounted on the head meshing with a stationary gear rack 42, a slidably mounted gear rack 44 reciprocated by the gear, as it moves across the stationary rack, and sheet engaging rollers 45 carried by a support 46 pivotally mounted on an arm 47 secured to the slidable rack at 48. The sheet engaging rollers 45 are constructed and arranged to rotate during the backward or return stroke and to be rigid during the forward or sheet moving stroke.

Sheet conveyor

The sheet conveyor means 26 are illustrated in Figures 1, 2, 3, and 4 as comprising a plurality of spaced flat belts 50, six being shown, and a pulley 51 mounted on a shaft 52 journalled adjacent the forward end of the stack 35 and a similar pulley mounted on a shaft 54 journalled on the frame adjacent the base 20 (Figure 1), the belts extending over the pulleys and providing two sets of six vertical strands, one set of which is adjacent the trays for a purpose to be described hereinafter.

To facilitate cooperation with the sheet feeding mechanism, a pivotally supported idler roll 55 (Figures 2, 3, and 4) rests on the belts above the upper pulley 51 and a vertical guide plate 56 with an inclined upper end 57 shrouds the roll, whereby the sheets are fed between the roll and belts (Figure 3) and are moved between the belts and the guide plate and propelled downwardly for delivery to the trays and compartments.

Sheet collecting trays

The sheet collecting trays 24, as illustrated in Figures 1, 4, and 5, are supported in inclined position between the upright frame 21 with the upper ends thereof adjacent one set of strands of the conveyor belts 50. Any suitable number of trays may be provided, for example fifty-one, one hundred and one or more, although only some of these trays are shown for purposes of illustration. The odd tray is provided as a cover over tray number 1 into which the first sheet is deposited.

The trays comprise a rectangular bottom 60 (Figure 5), side walls 61, and spaced members 62 hinged at the lower ends of the trays, which members are urged into upright position by springs 63 for retaining the sheets in the trays. The hinged members 62 are also adapted to be swung readily into substantially the plane of the bottoms to facilitate removal of sheets from the trays.

The bottoms 60 of the trays are formed with cutaway portions or openings 64 adjacent the lower edges thereof to facilitate stapling or otherwise fastening the sheets together prior to removal from the trays. Preferably, these openings are provided intermediate the hinged member 62 to render portions of the sheets accessible for stapling without disturbing the hinged members 62; or the openings 64 may be formed adjacent the right and/or left edges, as viewed in Figure 5, to enable the sheets to be stapled at the corners instead of centers.

In order to prevent the sheets from rebounding upon contacting the hinged members and moving backwards towards the upper ends of the trays, each tray is provided with sheet retaining means adjacent but spaced from the upper end thereof. These means, as shown, comprise a pair of spaced tabs or fingers 65 projecting upwardly from the tray bottom in a direction from the upper to the lower end of the tray over which the sheets are adapted to pass in a downwardly direction but providing a V-shaped pocket or trap for preventing excessive rearward movement of the sheets. Each tray also has a detent or bead 66 extending across and at the underside of its bottom, which detent is adjacent but is spaced slightly in a downward direction from the free edge of a tab 65 of a tray beneath it whereby the rear edge of a rebounding sheet tending to follow the underside of a tray engages the bead 66 and is guided or deflected into the pocket provided by the tabs.

Each tray has an aperture 67 between the upper end and the retaining fingers or tabs 65 which apertures are aligned with respect to each other, the light source 34, and the photoelectric cell 32, whereby movement of a sheet into a tray breaks the beam of light and effects release of a relay in the photoelectric cell unit, as will appear hereinafter. By providing the tabs for arresting undue rearward movement of the sheets once they have passed the apertures 67, false operation of the photoelectric cell circuit is avoided.

Tray gates

As shown in Figures 4, 5, and 6, each tray has a gate 25 intermediate its upper end and the sheet conveying belts 50 adapted to be selectively positioned to guide a sheet into a tray or to prevent the entry of a sheet into the tray.

These gates comprise a strip 70 formed with recesses 71 at the upper edge thereof for cooperat-

ing with the belts 50 (Figure 6), and trunnions 72 and 74 for pivotally mounting the gate strips between the upright frame 21.

In one position of operation, as seen in Figure 4, the upper portions of the gates are swung away from the belts 50 to block the entrances to their trays, while the lower portions of the gates lightly touch the belts to enable the sheets to pass therebetween with the right amount of friction. In another position of operation, the upper edges of the gates are swung toward the belts 50 with the belts disposed in the recesses 71, so that a sheet conveyed by the belts is guided therefrom by the gates into a tray. In the preferred manner of operating the apparatus, only one gate at a time is open while the other gates are closed, and the gates are opened step-by-step, that is, successively to admit sheets to their associated trays and are then respectively closed.

Gate operating means

In order to accomplish the foregoing manner of operation, gate operating means, such as illustrated in Figures 6 to 10, are provided. Such means comprise a member 80 (Figure 9), rigidly connected to the outward end of each trunnion 74, having a pair of extensions 81 and 82, and a pair of projections 84 and 85 on the chain 29 adapted to engage the extensions 81 and 82, respectively, to effect movement of the gates from one position to another. As shown in Figure 8, the chain 29 is constrained in a predetermined path by guide members 83.

As illustrated herein, the projection 84 serves as a tripper for successively engaging the extensions 81 normally in the downward movement of the chain 29 and for rocking the members 80 into a gate opening position. Upon such movement, the extension 82 of the tripped member 80 is moved into the path of the projection 85 which, upon subsequent further movement of the chain in a downward direction, as viewed in Figures 7 and 9, serves to reset the tripped member and effect reclosing of its gate. To provide for positive and quick movement of the gate from an open to a closed position and vice versa, a resilient element, such as a snap action spring 86, is anchored at one end, as shown in Figure 10, with a pair of arcuate portions 87, 88 at its free end in respective abutting engagement with an edge portion of its associated gate adjacent the trunnion 74 (Figure 6). Thus it is readily apparent that in the open position the gate will be held by the portion 88 of this spring and by portion 87 in the closed position, the gate being snapped from one spring portion to the other.

Drive mechanism

The drive mechanism 30 is illustrated in Figures 1 and 11 and includes a motor 90 for effecting travel of the belts 50 by rotation of the pulley shaft 54 through a pulley 91 thereon driven by a belt 92 on a drive pulley 94 of the motor. In addition, the chain 29 is driven step-by-step through an electromagnetic solenoid 95 having a movable, spring biased, core 96 pivotally connected to one end of a bell crank 97, an intermediate portion of the latter being pivotally supported upon a bracket 98 secured to the base 20. The other end of the bell crank is provided with a pawl 99 which is adapted to engage the teeth of a ratchet or gear wheel 100 about which the chain 29 is driven step-by-step. The chain 29 is also in mesh engagement with a sprocket wheel 101 freely rotatable upon a shaft 102 carried upon a supporting element 104. It is thus readily seen that actuation of the solenoid 95 through pawl 99 and ratchet wheel 100 imparts a predetermined movement to the chain 29 which is in mesh engagement with sprocket 101 at the bottom and sprockets 103 (Figure 2) at the top of the mechanism.

Operation

In operation, a stack of sheets to be distributed is first placed on the feeding platform and the chain 29 is positioned with its projections 84 and 85 adjacent the uppermost gate member 80 of the uppermost tray, that is, of the No. 1 compartment, so that the gate No. 1 is tripped into the open position by the projection 84 upon energization of the chain stepping solenoid 95, as will presently appear. The gates thereunder are in a closed position. The photoelectric cell unit is first energized by closing the power switch (not shown) therefor in order to permit the vacuum tube 106 (Figure 12) thereof to warm up, after which the drive motor 90 for the belts 50, the paper feed motor 36, and the lamp 34 are energized by closing the power switch 107, which is shown connected to a suitable source of alternating current energy.

At this point it may be mentioned briefly that the photoelectric circuit, particularly shown in Figure 12, is of conventional type, the primary elements comprising the photoelectric tube or cell 32, amplifying vacuum tube 106, and relay 108. The function thereof is such that, when the beam of light emitted by lamp 34 is impressed upon the cell 32, the relay 108 is energized. Upon operation of relay 108 an obvious circuit is closed for energization of the chain moving electromagnet or solenoid 95, which, in operating, attracts its core 96 and moves the chain 29 one step, as described hereinbefore. However, when the beam of light is interrupted, as by a sheet of paper passing via the opening 67 into a tray, the relay 108 is deenergized and the solenoid 95 released, the core 96 being retracted to its outward position by a spring (not shown) to move the pawl 99 back one tooth on ratchet wheel 100. After the sheet passes the opening 67 and the light beam is reinstated, relay 108 and solenoid 95 reoperate to rotate the ratchet wheel 100 and chain one step via movement of pawl 99. Thus following each interruption of the light beam the chain 29 is moved one step.

Accordingly, with the first gate in the open position and the paper feed motor energized, a sheet is fed from the top of the stack by the one-way rotating rollers 45 and delivered to a point between roller 55 and belts 50 (Figure 3), where the belts pick up the sheet and convey it past the guide 56 and open gate 25 to the uppermost tray 24. As the sheet moves across the opening 67 (Figs. 4 and 5) of the tray, the beam of light between lamp 34 on the base and the photoelectric cell 32 at the top platform is interrupted, whereupon relay 108 releases and chain solenoid 95 permits its spring biased core 96 to be retracted in the manner already described. After the end of the sheet has cleared the opening 67, the sheet now being deposited in compartment No. 1, the beam of light reactuates the photoelectric cell 32 and the relay 108 and solenoid 95 are reenergized. Core 96 in being attracted actuates the bell crank 97 and, in turn, the ratchet wheel 100, which moves the chain 29 one step. The chain projection 84 then effects opening of the tray gate to compartment No. 2.

while the chain projection 85 closes the uppermost gate. For the upper compartments all of this operation occurs before the next sheet is fed from the stack and conveyed by the belts, whereby the second gate is positioned in ample time to guide the second sheet into the second compartment. Each time a sheet breaks the light beam the next gate is opened and the previously opened gate is closed. Since the closed upper gates maintain the sheets against the belts, the sheets move downwardly in each instance until they reach an open gate.

The above operation continues until a sheet has been placed into the lowermost compartment. However, it will be readily understood that, where there is a substantial number of trays, the feeding of the sheets must be stopped a predetermined time in advance of the opening of the lowermost gate in order to avoid a surplusage of sheets on the conveyor belts and also to provide for initiation of a new cycle.

In a one hundred compartment arrangement it is readily apparent that 101 trays are required, since the upper tray acts as a cover for the first compartment to provide a surface with which the tabs 65 may cooperate. Also in a one hundred compartment arrangement the chain 29 must comprise 300 links in order that as gate #100 is closed gate #1 is opened.

Thus to provide for the beginning of a new cycle at the proper time, it has been found necessary to stop the paper feeding mechanism instantly at a predetermined moment, say when gate #98 is opened. Of course, this depends on the speed of the conveyor belts and it may be necessary to stop the paper feed motor at some other gate. This is accomplished by a microswitch 109 (Figs. 7 and 12) mounted upon the upper platform, which microswitch has an extending resilient finger 110 adapted to be depressed by the resetting projection 85, as shown in dotted outline in Fig. 7. The operation of the microswitch closes an operating circuit for a relay 112 (Fig. 12), which circuit may be traced from the lower pole of power switch 107 through normally closed recycling switch 111, lead 113, contacts of operated microswitch 109, lead 114, and thence to the other pole of switch 107, via the winding of the relay 112. Relay 112, in operating, at its upper and lower back contacts 115 opens the operating circuit of the paper feed motor 36 and at its upper and lower front contact 116 closes an energizing circuit for a solenoid 117 (see also Fig. 1), which actuates a brake mechanism 118 to instantly stop rotation of the paper feed motor 36. A locking circuit for relay 112 is also rendered effective to maintain the relay operated following passage of projection 85 beyond engagement with finger 110; which circuit may be traced from the lower pole of switch 107 via recycling switch 111 and lead 113, through lower front contact 116, strap 119, and through the relay winding to the other pole of switch 107. The three sheets already being conveyed to compartments #98, #99, and #100 will be routed thereto in the hereinbefore described manner, thereby completing the cycle for the first supply stack of sheets, one sheet having been delivered to each of the 100 compartments. Upon completion of the cycle the recycling switch 111 is opened to deenergize the relay 112 and the brake solenoid 117.

A second stack of sheets is moved into position on the platform immediately upon deenergization of the paper feed motor, that is, after the last sheet has been picked up, or after a sheet is fed to the lowermost compartment, and recycling switch 111 is closed to initiate the next series of sheet feeding operators. Gate #1 is then opened and the distributing operation is carried out in the same manner as hereinbefore described. This operation is continued with succeeding sheets until the desired number of sheets have been distributed into sets.

From the foregoing description it will be seen that the present invention provides an improved sheet distributor which is simple in construction and rapid and positive in operation. The sheets are accurately distributed into sets and are readily fastened together.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matters are to be interpreted as illustrative and not in any limiting sense.

What is claimed is:

1. In a sheet distributor, the combination of a plurality of inclined trays for collecting sheets, a conveyor adjacent and movable past the upper ends of said trays for delivering sheets seriatim thereto, a gate for each of said trays between said conveyor and said trays, said gates being pivotally mounted and adapted in one position to direct sheets into said trays and in another position to prevent the entry of sheets into said trays, tripping and resetting means on each of said gates, photo-electric means responsive to the entry of sheets into said trays, and means under the control of said photo-electric means for directing sheets into said trays successively, said last means including a chain for actuating said tripping and resetting means step by step, whereby said gates are moved successively from said one position to the other position.

2. In a sheet distributor, the combination of a plurality of inclined trays for collecting sheets positioned one above another having an entrance at the upper ends thereof, a conveyor having a vertical strand adjacent said entrance of each of said trays, a gate for each of said trays between said conveyor and said tray entrances, said gates being pivotally mounted about a horizontal axis and adapted to be selectively positioned to direct sheets into said trays while in one position and to prevent the entry of sheets into said trays while in another position, photo-electric means responsive to the entry of sheets into said trays, means under the control of said photo-electric means for moving said gates from said one position to the other position, said gate moving means including an endless chain having means thereon for positioning said gates, and intermittently operated drive means for effecting movement of said chain.

3. In a sheet distributor, the combination of a plurality of inclined trays for collecting sheets positioned one above another having an entrance at the upper ends thereof, a conveyor having a vertical strand adjacent said entrance of each of said trays, a gate for each of said trays between said conveyor and said tray entrances, said gates being pivotally mounted about a horizontal axis and adapted to be selectively positioned to direct sheets into said trays while in one position and to prevent the entry of sheets into said trays while in another position, photo-electric means responsive to the entry of sheets into said trays,

means under the control of said photo-electric means for moving said gates from said one position to the other position, said gate moving means including an endless chain having means thereon for positioning said gates, intermittently operated drive means for effecting movement of said chain, and a resilient finger with a pair of arcuate portions for each of said gates for positively holding its associated gate in an open or closed position.

4. In a sheet distributor, the combination of a plurality of compartments for collecting sheets, a plurality of belts movable past said compartments for delivering sheets to said compartments, a gate for each of said compartments for controlling the entry of sheets therein, each of said gates having a plurality of recesses for passage therethrough of said belts, photo-electric means for controlling operation of said gates responsive to the entry of sheets into said compartments.

5. In a sheet distributor, the combination of a plurality of inclined trays positioned one above another for collecting sheets and having an entrance at the upper end thereof, a plurality of belts movable past said trays and having spaced vertical strands adjacent said entrances, a pivotally mounted horizontally extending gate for each of said trays between said belts and said entrances each having recesses for passage therethrough of said belts, and means for moving said gates about their pivot to control the entry of sheets into said trays.

6. In a sheet distributor, the combination of a plurality of trays positioned one above another for collecting sheets having an entrance at one end thereof between adjacent trays, a conveyor adjacent said entrances for delivering sheets to said trays, a gate for each tray extending across its entrance adjacent said conveyor and being pivotally mounted to be moved into and inclined position for directing sheets from said conveyor into said trays and to be moved into a position to close said entrances to prevent sheets from entering said trays, each of said gates having a projection at one end thereof, and means for controlling the operation of said gates including an endless chain having means thereon for engaging said gate projections to move said gates from one position to another.

7. In a sheet distributor, an inclined tray for collecting sheets having an entrance at its upper end and a retaining member at its lower end, and having means adjacent its upper end inclined to permit sheets to pass thereover and be deposited in said tray and provided with a portion facing the lower end for deflecting rearwardly bounding sheets deposited in said tray away from said upper end, and a second inclined tray above said first tray having a transverse bead disposed rearwardly of said inclined means and extending into a path traversed by said sheets, whereby in conjunction with said inclined means said bead is adapted to direct said rebounding sheets against said porton.

8. In a sheet distributor, the combination of a plurality of trays arranged one above each other and having an entrance at one end thereof, conveyor means substantially perpendicular to said trays and adjacent said entrances for delivery of sheets to said trays, and a gate between each entrance and said conveyor means for selectively closing said entrances and for deflecting sheets delivered by said conveyor means and into said entrances, one side of said gate being in frictional engagement with said conveyor means while closing said entrances.

9. A sheet distributor according to claim 8, wherein said conveyor means comprise a plurality of spaced belts and said gates are in the form of strips having recesses at the other side thereof for passage therethrough of said belts when positioned to deflect sheets into said entrances.

10. A sheet distributor according to claim 8, wherein each gate has an extension at one end thereof, and a chain adjacent said entrances is provided with a projection cooperating with said extensions for successively moving said gates into position to close said entrances and is provided with a projection cooperating with said extensions for moving said gates into position to deflect sheets into said entrances.

11. A sheet distributor according to claim 8, wherein each gate has an extension at one end thereof, a guideway, and a chain in said guideway adjacent said entrances is provided with a projection cooperating with said extensions for successively moving said gates into position to close said entrances and is provided with a projection cooperating with said extensions for moving said gates into position to deflect sheets into said entrances.

DAVID C. McGALLIARD.

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